



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
PREVENTION, PESTICIDES
AND TOXIC SUBSTANCES

Note to Reader

Background: As part of its effort to involve the public in the implementation of the Food Quality Protection Act of 1996 (FQPA), which is designed to ensure that the United States continues to have the safest and most abundant food supply.

EPA is undertaking an effort to open public dockets on the organophosphate pesticides. These dockets will make available to all interested parties documents that were developed as part of the U.S. Environmental Protection Agency's process for making reregistration eligibility decisions and tolerance reassessments consistent with FQPA. The dockets include preliminary health assessments and, where available, ecological risk assessments conducted by EPA, rebuttals or corrections to the risk assessments submitted by chemical registrants, and the Agency's response to the registrants' submissions.

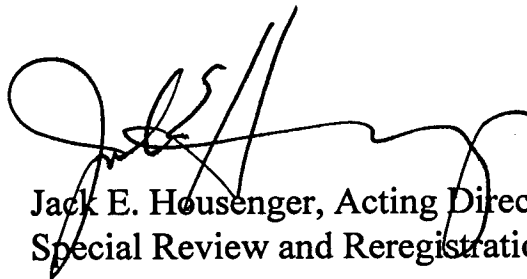
The analyses contained in this docket are preliminary in nature and represent the information available to EPA at the time they were prepared. Additional information may have been submitted to EPA which has not yet been incorporated into these analyses, and registrants or others may be developing relevant information. It's common and appropriate that new information and analyses will be used to revise and refine the evaluations contained in these dockets to make them more comprehensive and realistic. The Agency cautions against premature conclusions based on these preliminary assessments and against any use of information contained in these documents out of their full context. Throughout this process, If unacceptable risks are identified, EPA will act to reduce or eliminate the risks.

There is a 60 day comment period in which the public and all interested parties are invited to submit comments on the information in this docket. Comments should directly relate to this organophosphate and to the information and issues available in the information docket. Once the comment period closes, EPA will review all comments and revise the risk assessments, as necessary.

These preliminary risk assessments represent an early stage in the process by which EPA is evaluating the regulatory requirements applicable to existing pesticides. Through this opportunity for notice and comment, the Agency hopes to advance the openness and scientific soundness underpinning its decisions. This process is designed to assure that America continues to enjoy the safest and most abundant food supply. Through implementation of EPA's tolerance reassessment program under the Food Quality Protection Act, the food supply will become even safer. Leading health experts recommend that all people eat a wide variety of foods, including at least five servings of fruits and vegetables a day.

Note: This sheet is provided to help the reader understand how refined and developed the pesticide file is as of the date prepared, what if any changes have occurred recently, and what new information, if any, is expected to be included in the analysis before decisions are made. **It is not meant to be a summary of all current information regarding the chemical.** Rather, the sheet provides some context to better understand the substantive material in the docket (RED chapters, registrant rebuttals, Agency responses to rebuttals, etc.) for this pesticide.

Further, in some cases, differences may be noted between the RED chapters and the Agency's comprehensive reports on the hazard identification information and safety factors for all organophosphates. In these cases, information in the comprehensive reports is the most current and will, barring the submission of more data that the Agency finds useful, be used in the risk assessments.

A handwritten signature in black ink, appearing to read 'J. Housenger', is written over the typed name and title.

Jack E. Housenger, Acting Director
Special Review and Reregistration Division

282



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OFFICE OF
PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

June 1, 1999

MEMORANDUM

SUBJECT: **Chlorpyrifos** (List A, Case No. 0100). Anticipated Residues for Chronic Dietary Exposure Assessment for Chlorpyrifos RED. Chemical No: 059101; DP Barcode: D255451; No MRID No. Case No. 0100

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Executive Summary

Anticipated residues for chlorpyrifos on currently supported crops, please see the summary in Table 9.

Background

A chronic dietary exposure assessment which incorporated certain percent crop treated and anticipated residue data was also conducted using OPP's DRES system assuming 100% crop treated and tolerance level residues. The resulting chronic dietary risk analysis indicated that dietary risks for all populations and subgroups were below the Agency's level of concern at that time (3/26/96, B. Steinwand, Dietary Exposure Analysis). The chronic analysis showed that 15.3 percent of the RfD was occupied for the general U.S. Population, with the highest subgroup being non-nursing infants (< 1 year old) with 58.4 % of the RfD occupied. Thus, OPP concluded at that time that there was no chronic dietary concern for the published uses of chlorpyrifos.

HED has been asked to update the dietary exposure analysis for the Reregistration Eligibility Decision HED Risk Assessment based on availability of additional PDP data and Dow's Market Basket Survey. As per current HED policy, chronic exposure assessments are conducted with mean residue values and incorporate information on the percent of a crop which is treated by assuming non-treated crops contain no pesticide residues and that treated crop with non-detectable residues contain pesticide at ½ the limit of detection. Briefly, these calculated mean pesticide residues are preferentially obtained from either USDA PDP, FDA monitoring programs or market basket. When market basket survey, PDP or FDA monitoring data for the crop in question are not available, translation of pesticide residue data from other monitored crops may be performed on a case-by-case basis when certain conditions are met. When monitoring data are not available, mean values for use in chronic assessments can be calculated from residues from crop field trials and adjusted for % of the crop treated. Finally, if inadequate monitoring or field trial data are available, tolerance values (also adjusted for percent of crop treated) can be used.

Table 1. Below summarizes the PDP and FDA monitoring data available for use in our updated chronic risk assessments.

USDA PDP Data Summary

Table 3. USDA Pesticide Data Programs Summarized for Chlorpyrifos during the years 1993 to 1997

Year	Commodity	Total Samples screened	Samples With Detections	% of Samples with Detections	Minimum Value Detected, ppm	Maximum Value Detected, ppm	Range of LODs, ppm	Tolerance	Codex MRLS, ppm
1996	Apple Juice	177	0				0.002-0.011	1.5	
1997	Apple Juice	683	1	0.1	0.015	0.015	0.003-0.011	1.5	1
1993	Apples	643	124	19.3	0.005	0.36		1.5	
1995	Apples	692	153	22.1	0.005	0.42		1.5	
1996	Apples	530	140	26.4	0.003	0.23	0.002-0.009	1.5	
1994	Apples	687	132	19.2	0.003	0.27		1.5	
94-96	Bananas	1126	0	0	0	0		0.01	
1993	Broccoli	630	9	1.4	0.005	0.3		1	
1994	Broccoli	679	11	1.6	0.005	0.025		1	
1994	Carrots (V-2)	687	2	0.3	0.005	0.005		NT	
1995	Carrots (V-6)	701	6	0.9	0.005	0.019		NT	
1993	Carrots (V-3)	641	3	0.5	0.005	0.005		NT	
1996	Carrots (V-7)	500	7	1.4	0.005	0.074	0.003-0.011	NT	
1993	Celery (V-6)	634	6	0.9	0.005	0.018		NT	
1994	Celery (V-4)	176	4	2.3	0.005	0.045		NT	
1995	Celery (V-6)	701	6	0.9	0.005	0.019		NT	
1993	Grapefruit	632	2	0.3	0.005	0.005		1	
1995	Grapes (V-9)	690	56	8.1	0.005	0.16		0.5 R	
1993	Grapes	621	28	4.5	0.005	0.15		0.5	
1994	Grapes	669	34	5.1	0.005	0.11		0.5	
1996	Grapes (V-13)	525	72	13.7	0.005	0.44	0.003-0.011	0.5 R	
1993	Green Beans (X-2)	562	5	0.9	0.005	0.38		0.05	
1997	Green Beans	707	0				0.003-0.011	0.05	0.2
1996	Green Beans	531	0				0.003-0.011	0.05	
1994	Lettuce	691	1	0.1	0.01	0.01		NT	
1997	Orange Juice	692	1	0.1	0.005	0.005	0.003-0.009	1	0.3
1993	Oranges	633	30	4.7	0.003	0.014		1	
1995	Oranges	691	50	7.2	0.005	0.019		1	
1994	Oranges	683	32	4.7	0.005	0.023		1	
1996	Oranges	518	62	12	0.003	0.028	0.002-0.009	1	

Year	Commodity	Total Samples screened	Samples With Detections	% of Samples with Detections	Minimum Value Detected, ppm	Maximum Value Detected, ppm	Range of LODs, ppm	Tolerance	Codex MRLS, ppm
1993	Peaches	367	42	11.4	0.005	0.18		0.01	
1996	Peaches	324	55	17	0.005	0.035	0.003-0.009	0.05	
1995	Peaches	367	60	16.3	0.005	0.034		0.05	
1994	Peaches	396	15	3.8	0.005	0.03		0.05	
1997	Peaches	754	0				0.003-0.009	0.05	
1997	Pears	708	13	1.8	0.005	0.054	0.003-0.011	0.05	0.5
1994	Potatoes (V-1)	694	1	0.1	0.024	0.024		NT	
1996	spinach (V-26)	517	26	5	0.003	0.03	0.002-0.009	NT	
1995	Spinach (V-46)	610	46	7.5	0.005	0.11		NT	
1997	Spinach, Canned	168	0				0.003-0.009	NT	
1997	Spinach, Fresh (V-11)	512	11	2.1	0.005	0.026	0.003-0.009	NT	
1996	Sweet Corn	173	0				0.003-0.011	0.1	
1996	Sweet Peas	355	1	0.3	0.005	0.005	0.003-0.011	0.1	
1997	Sweet Potatoes	695	76	10.9	0.005	0.026	0.003-0.011	0.05	
1996	Sweet Potatoes	507	53	10.5	0.005	0.086	0.003-0.011	0.05	
1997	Tomatoes	707	92	13	0.005	0.31	0.003-0.011	0.5	0.5
1996	Tomatoes	174	17	9.8	0.005	0.11	0.003-0.011	0.5	
1997	W. Squash, Frozen (V-4)	221	4	1.8	0.005	0.005	0.003-0.011	NT	
1997	W. Squash, Fresh	440	0				0.003-0.011	NT	

Market Basket Survey Data from Results of the **National Food Survey Conducted in 1993-1994** reviewed by Leung Cheng, May 19, 1998, MRID 43721601 DP Barcode: D217707, and D242445. DowElanco (now Dow AgroSciences) initiated a market basket survey in 1993 to better determine the acute dietary exposure of chlorpyrifos to consumers. The survey was conducted at the registrant's own initiative. A study protocol had previously been submitted and was reviewed by CBRS with few comments (M. Clifford & S. Knizner, 4/8/94).

Table 2. Survey Results of Chlorpyrifos in Selected Food Items

Matrix ^a	% RAC Treated (1992) ^b (1998) ^f		LOQ ^c (ppm)	% Samples >LOQ	LOD ^c (ppm)	% Samples <LOQ but >LOD	% Samples <LOD	Maximum Chlorpyrifos (ppm)	Tolerance (ppm)
Fresh Apple	58	53	0.007	19.5	0.002	14.5	66	0.052	1.5
Applesauce			0.008	0	0.002	2	98	<LOQ	
Apple Juice			0.003	0	0.0008	1	99	<LOQ	
Orange Juice	24	19	0.007	0.5	0.002	0	99.5	0.015	1.0 (citrus)
Tomato ^d	2	3	0.005	18.5	0.002	11.1	70.4	0.058	0.5
Peanut Butter ^e	31	8	0.005	46	0.002	38.5	15.5	0.021	0.2 (peanut)
Whole Milk			0.006	0	0.002	0	100	<LOD	0.01
Ground Beef			0.005	0	0.002	0.5	99.5	<LOQ	0.05 (meat)
Pork Sausage			0.007	0	0.002	0.5	99.5	<LOQ	0.05 (mbpt)

^a Number of samples analyzed: 200 for apple, applesauce, apple juice, peanut butter, whole milk, ground beef and pork sausage; 195 for orange juice (for lack of ready-to-drink 100% o.j. at the predetermined stores); and 54 for tomato. ^b Percent of raw agricultural commodity treated nationally. ^c Calculated. ^d Collected in Florida only due to regional registration. ^e It is not apparent why the percent of detects (>LOD) is substantially higher than the percent of peanut treated with chlorpyrifos. ^f Percent of raw commodity treated nationally.

Table 3. Market Basket Summary information:

	Apple	Applesauce	Apple Juice	Orange Juice	Tomato	Peanut Butter	Whole Milk	Ground Beef	Pork Sausage
Mean (ppm)	0.0048	0.001	0.00041	0.001	0.0044	0.0049	0.001	0.001	0.001
95%tile (ppm)	0.023	0.001	0.0004	0.001	0.014	0.012	0.001	0.001	0.001
Sample #	200	200	200	195	54	200	200	200	200
LOD (ppm)	0.002	0.002	0.0008	0.002	0.002	0.002	0.002	0.002	0.002
LOQ (ppm)	0.007	0.008	0.003	0.007	0.005	0.005	0.006	0.005	0.007

The following information describes, for each crop of interest for which reregistration is sought, the pesticide and other data used to calculate the mean residue, for use in our chronic dietary risk assessment.

Apples: The total number of apples sampled by PDP during 1994 to 1997 was 1908; of these analyzed samples, 425 showed detectable residue levels (22%). The range of reported detects in the analyses is 0.003 to 0.42 ppm. Current HED practice for chronic exposure assessments to use the mean value of the monitoring data (incorporating BEAD maximum percent crop treated estimates and ½ LOD for treated commodities for which no detectable residues are found) for dietary exposure in a chronic risk assessment. BEAD has estimated that up to 53% of the apple crop can be treated with chlorpyrifos. Using PDP data (tier 3) from 1994 to 1997, the anticipated residue for the dietary exposure portion of the chronic risk assessment for apples is calculated to be 0.0077 ppm. Using market basket data (tier 4) submitted by the registrant the anticipated residue for apples is 0.0048 ppm and for applesauce is 0.001 ppm calculated using a straight mean of detectable residues and ½ LOD.

Apple Juice/Concentrate: A total of 860 samples of apple juice were analyzed by PDP in 1996 and 1997. There was 1 detect (0.1 % of samples had a detect) at 0.015 ppm. The range of LODs reported by PDP was 0.003-0.011 ppm. The anticipated residue is calculated as 0.001728 ppm assuming non-detectable residues were present at 1/2 LOD .

Beets: Root and tuber percent crop treated estimates were used from BEAD. Thus 19% of beets were assumed to be treated. No residue data on beets have been collected by PDP. Beets are treated similarly to other roots and tubers, including sweet potatoes. Therefore, sweet potato PDP anticipated residues are translated to beets the anticipated residue for beets is .001211 ppm for use in chronic dietary assessment.

Fresh Orange/Grapefruit/Lemons/Citrus: There were 1891 orange samples analyzed during the years 1994 to 1996 in the PDP monitoring data with 144(8%) detects. The estimated percent crop treated per BEAD's 11/98 memo is 19%. BEAD also provided estimates that 10% of oranges used for processing and 54% of oranges eaten fresh are treated with chlorpyrifos. As per HED policy, the mean value of the monitoring data (incorporating percent crop treated where appropriate using BEAD estimated values percent crop treated data when available), used for dietary exposure in a chronic risk assessment. The mean concentration from orange monitoring data is 0.0009145 ppm, assuming 54 % of crop treated. This is the anticipated residue recommended for use in the dietary exposure portion of the chronic risk analysis for extra fruit (including fresh oranges.)

Orange Juice/Grapefruit Juice/Lemons Juice/Citrus: EPA will use the USDA generated Pesticide Data Program (PDP) monitoring data in its chlorpyrifos risk assessment. There are 692 analyses for 1996 in the PDP monitoring data with 1 (0.1%) detects. The percent crop treated from BEAD's 11/98 memo is 10% for processed for oranges. for dietary exposure in a chronic risk assessment. The mean concentration (using BEAD percent crop treated estimated for oranges at 10% and 1996 PDP residue data for oranges) from orange juice monitoring data is 0.000441 ppm. This is the anticipated residue recommended for use in the dietary exposure

portion of the chronic risk analysis for all citrus juice (i.e. oranges, grapefruit, and lemons since the percent crop treated, treatment rates and PHI's are similar.)

Cranberries: FDA has 74 results with 26 detects for cranberries between 1992 to 1997. These results are fairly well distributed geographically. We note that the percent crop treated is 34% yielding an estimated 25 detects. Since current policy requires at 100 samples to use monitoring data, field trial data will be used instead.

3 field trials in Washington, Wisconsin and Massachusetts covers approximately 100% of the geographical distribution growing regions. The current registered pesticide treatment rate is 2 applications per season of 1.5 lb ai/A each with a PHI of 60 days. All results were measured as TCP and have been converted to chlorpyrifos by dividing by 0.56, the ratio of the molecular weights. BEAD provided estimates of 60 % crop treated. Residue values ranged from 0.75 ppm to 0.036 ppm. The calculated mean from this data, using the 60% crop treated estimate from BEAD, is 0.1 ppm which should be used in the chronic dietary assessment. For cranberry juice, this mean cranberry residue value should be used in the dietary assessment along with the grape juice processing factor of 0.3x.

Kiwi Fruit: FDA collected 124 kiwi fruit samples during the years 1992-1993 and 1996-1997 which resulted in one residue at 0.010 ppm. BEAD did not report a percent crop treated for kiwi so 100% was used as a default value. The resulting anticipated residue is calculated to be 8×10^{-5} ppm, assuming all ND value residues are present at $\frac{1}{2}$ LOD.

Mushrooms: Tolerance values (0.1 ppm) will be used for this commodity as FDA, PDP or market basket survey monitoring data is not available. Percent crop treated data indicate less than 1 percent of the US mushroom crop is treated with chlorpyrifos. The anticipated residue is calculated by multiplying percent of crop treated times the tolerance and results in an anticipated residue of 0.001 ppm to be used in the chronic risk assessment.

Onions (dry bulb): FDA collected 230 samples during the years 1992 - 1997 and showed no detectable residues with a limit of detection of 0.003 ($\frac{1}{2}$ LOD of 0.00015 ppm). Percent crop treated data, from BEAD, indicate that maximum %CT is 19%. The calculated anticipated residue is 0.00003 ppm assuming 19% of the samples contain residues of $\frac{1}{2}$ LOD and the remainder do not contain any residues (untreated).

Peppers, Green: FDA collected 368 samples during the years 1992 - 1997 which resulted in 19 residues (ranging from: 0.770 ppm and 0.930 ppm) above the limit of detection. The maximum percent crop treated from BEAD is: 3%. The mean residue of 0.0083 ppm will be used for anticipated residue. This value was calculated by assuming that 95% of the samples were 0, and the remaining 19 (5%) residues were present at their level detected.

Sunflower seeds (10/95 S. Knizner Memo)

An AR of 0.046 ppm for sunflower seed was taken from Knizner, S. Chlorpyrifos Anticipated Residues for DRES Acute Analysis, DP Barcode: D216468, 10/95. BEAD estimates that less than 1% of the sunflower crop treated, so HED uses a conservative estimate that 1% of the crop is treated to yield a value of 0.00046 ppm.

Sunflower Seed Oil: Sunflower Seed Processing Study (MRID #431841401)

Sunflower seed oil anticipated residue (AR) was taken from the sunflower seed AR and a processing factor of 1x from Knizner, S. Chlorpyrifos Anticipated Residues for DRES Acute Analysis, DP Barcode: D216468. Using 1% crop treated, this yields 0.00046 ppm.

Tomatoes, Fresh: EPA will use the PDP data provided by the USDA. During 1996 and 1997 PDP collected 881 samples of tomatoes and found 109 (12%) detections. The BEAD estimated that the maximum percent crop treated for tomatoes is 3%. Current practice for chronic exposure assessments is to use the mean value of the monitoring data (using BEAD percent crop treated estimated for fresh tomatoes at 3% and 1996 & 1997 PDP residue data for tomatoes) for dietary exposure in a chronic risk assessment. The anticipated residue used for the dietary exposure portion of the chronic risk assessment for tomatoes is 0.00443 ppm used for tier 3 chronic dietary analysis. The registrant also submitted a market basket survey of 54 tomatoes from Florida. There were 17 positive findings up to 0.0565 ppm. The anticipated residue value from the market basket survey used for tier 4 analysis is 0.0044 ppm.. It is noteworthy that PDP data are more recent, represent a greater number of samples, are considered highly representative of the national distribution, both Dow's Market Basket Survey and PDP data result in the same anticipated residue estimate.

Tomatoes, Processed: Tomato Juice, Puree, Paste, and Catsup - Previously calculated anticipated residues for tomato processed commodities (N.Dodd, PP#4F03008, CBTS #10804, Barcode #D183901 (9/28/93) resulted in processing factors of 0.03 was used for juice and 0.1 was use for the paste, puree and catsup. This will be used in place of default concentration factors.

Walnuts/Pecans/Tree Nuts: Acceptable field trials have been performed for chlorpyrifos on various tree nuts, primarily almonds and walnuts (MRIDs 00132786, 00044555, 00116675, 41424401). The results of the field trials are tabulated below (Table 7a). All results are measured as the total TCP common moiety expressed as chlorpyrifos. The field trial data was adequate to support the establishment of a crop group tolerance. Combining almonds and walnuts provided 22 data points. All other nuts were translated from these. No LOD was reported for the method used in the field trials for nuts. Rather the sensitivity of the method was limited by the peak height found at the analyte retention time in the individual associated control samples. The corrected results in Table 4a were determined in the studies by subtracting the control results from the incurred results. Results of <0.025 meant that the results were <0.025 over the control results. Results reported as ND meant that the samples were not higher than the controls. Since the field trials clearly did not use averages of the control results, but used the highest control value in deciding whether a result was a reportable amount or ND, these highest results for the controls

constituted the practical LOD. Except for a single control result at 0.042, all results were less than 0.026. The BEAD estimated percents crop treated are 29% for almonds, 36% for pecans, 39% for walnuts and 9% for other tree nuts. An anticipated residue was calculated 0.02 ppm for walnuts, 0.014 for almonds, 0.018 for pecans and 0.0045 ppm for tree nuts in general using the field trial data and percent crop treated.

Table 4a. Field Trials for Tree Nuts

RAC	Site	Treatment	Number of Treatments	Lbs/A	PHI	Number of Samples	Results in Nutmeat
Almonds	Modesto	foliar	3	1.6	14	2	ND x 2
	Modesto	foliar	3	2.0	14	2	ND x 2
	Modesto	foliar	3	1.6	14	2	.04, <0.025
	Modesto	foliar	3	2.0	14	2	.03, <.025
	Davis	foliar	3	2.0	14	4	.04 x 3, ND
	Davis	foliar	3	2.0	14	4	.04, .04, .09, ND
	Sanger	foliar	3	2.0	16	4	.05, .07, .03, .06
	Sutter	foliar	3	2.0	15	4	.05, .03, .03, <.025
	Davis	foliar	3	2.0	14	4	.08, .09 X 2, .11
	Davis	foliar	3	2.0	14	4	.08 X 2, .07 X 2
Walnuts	Davis	foliar	3	2.0	12	4	ND x 4
Walnuts	Davis	foliar	3	2.0	12	4	ND x 4
Walnuts	Davis	foliar	3	2.0	12	4	ND x 4
Walnuts	Davis	foliar	3	2.0	12	4	ND x 4
	Visalia	foliar	3	2.5	17	4	ND x 3, <0.025
	Butte City	foliar	3	2.0	14	2	ND x 2
Almonds	Modesto	dormant	1	4???	N/A	4	<.05 x 4
Almonds	Modesto	dormant	1	4???	N/A	3	<.05, 2 X ND
	Arbuckle	dormant	1	4???	N/A	4	2 X .05, 2 x <.05
	Arbuckle	dormant	1	4???	N/A	4	4 X ND
	Davis	dormant	1	4???	N/A	9	8 x ND, <.05
Walnuts	Davis	dormant	1	4???	N/A	4	4 X ND

Table 4b. Comparison of Treatments for Different Tree Nuts

RAC	Treatment	Number of Treatments	Lbs/A	PHI
Almonds	dormant	1	2.0	N/A
	dormant	1	1 - 3	N/A
	foliar	3	2	14
	tree trunk	2	.015 - .045/tree	14
	soil	2	4	14
Filbert	foliar	3	2	14
Macadamia	foliar	8	1	14
Pecans	foliar	5	1 - 2	28
	soil	5	1 - 2	N/A
Walnut	dormant	1	2	N/A
	foliar	2	2	14

Vegetables, Leafy, Brassica (cole) [Crop Group 5] Broccoli, Brussels sprouts, cabbage, cauliflower, and chinese cabbage
There are PDP and FDA monitoring data for cole crops. This crop group includes broccoli (PDP data), brussels sprouts (translated from broccoli), cauliflower (translated from broccoli), cabbage (from FDA data), chinese cabbage (translated from cabbage), Bok choy (FDA data), collard (FDA data), kale (FDA data), mustard greens (FDA data). Beet and Kohlarabi used root green estimated percent crop treated from BEAD (19%) and collard residue data since the application are similar.

Broccoli: PDP collected 679 samples during the years 1994 through 1997 with 11 above level detection and 9 above the level of quantitation. BEAD estimated that a maximum of 51% of the broccoli crop is treated with chlorpyrifos. An anticipated residue of 0.001486 ppm was calculated by adding the 20 detected residue values with 333 0's and 326 ½ LOD values (*representing the percent of crop treated which did not result in a detectable residue.)

Brussels Sprouts: Brussels sprouts were translated from broccoli since their use patterns are similar. BEAD's most recent estimate of the maximum percent of crop treated is 100%, so the anticipated residue is 0.00281 ppm.. This was a calculated mean of the value for the residue samples with a detection and ½ LOD for the samples without a detection from broccoli PDP data.

Cauliflower, Cabbage, Collards, Kale, and Bok Choi: During 1992-1997 FDA sampled all Brassica crops except kohlrabi for chlorpyrifos. The FDA results are summarized in table 6. FDA data for cauliflower, cabbage, collards, kale and bok choy were used directly for each of those commodities. Although there were slightly less than 100 samples (normally required number for use of monitoring data) for bok choy, 96 samples was considered acceptable. Collards was translated to kohlrabi with an adjustment for percent crop treated. There were fewer than 100 results for mustard greens, so the data from collards was also translated to mustard greens with an adjustment for percent crop treated. Note that label treatment rates and PHI's are virtually the same for all of these crops.

Table 5. FDA Data for Different Brassica

RAC	% crop treated	Analyses	No. of Detects	Residue Values for Detects
cabbage	23%	491	8	0.070, 0.120, 0.0005, 0.010, 0.120, 0.135, 0.163, 0.043
cauliflower	36%	256	0	-
bok choy	assume 1%	96	1	0.200
collards	13%	147	4	0.0005, 0.020, 0.180, 0.020
kale	assume 1%	113	5	0.120, 0.010, 0.400, 0.145
mustard greens	assume 1%	85	3	0.100
kohlrabi	assume 1%	none reported	none reported	
TOTAL		1200	21	

The resulting calculations of anticipated residues for kale is 0.006 ppm, for cabbage (red, green, and chinese) is 0.00111 ppm, for mustard greens is 0.0015 ppm (from collards), for collards is 0.0015 ppm, for kohlrabi is 0.0015 ppm, and for bok choy is 0.0021 ppm.

Asparagus: FDA collected 166 samples which were used in calculating the anticipated residue for asparagus. The samples were collected during the years 1992 - 1997, with only two residue values of 0.087 and 0.0005 ppm found (1%). BEAD's estimated maximum percent crop treated for chlorpyrifos on asparagus is 12%. An anticipated residue of 0.0006 ppm was calculated for chronic analysis.

Grapes, Fresh: EPA will use the USDA generated Pesticide Data Program (PDP) monitoring data from the years 1994, 1995, 1996, and 1997. There are 1884 grape samples reported during the years 1994 to 1997 in the PDP monitoring data with 162 detects (8%). The highest detectable residue reported in grapes during this time period was 0.44 ppm. The percent crop treated from BEAD's 11/98 memo is 1%. The mean concentration from grape monitoring data is 0.00286 ppm. This is the anticipated residue recommended for use in the dietary exposure portion of the chronic risk analysis.

Grape Juice: The anticipated residue of 0.00286 ppm for fresh grapes was used for grape juice with an added processing factor of 0.3 (Knizner, S. Chlorpyrifos Anticipated Residues for DRES Acute Analysis, DP Barcode: D216468, 10/95). The same estimate was used for grape **wine** with a DEEM default processing factor of 1. For grape **leaves** the grape AR with the DEEM default processing factor of 1.5 was used. For grape **raisins** the grape AR was used with the processing factor of 0.17 (Knizner, S. Chlorpyrifos Anticipated Residues for DRES Acute Analysis, DP Barcode: D216468, 10/95).

Bananas/Plantains

EPA will use the PDP data sampled during 1994 to 1997 provided by the USDA which analyzed 1126 samples of bananas with no samples above the limit of detection. BEAD indicated that a

maximum of 14% of imported bananas are treated with chlorpyrifos. Incorporating the weighted average of ½ of the LOD is 0.00303 ppm and percent crop treated results in an anticipated residue of 0.000423 ppm. This was used for all food forms of bananas and plantains.

Meat/Milk/Poultry/Eggs (Cattle, Veal, Horse and Pork)

The registrant did a market basket survey of ground beef, collecting 200 samples with an LOD of 0.002 ppm. Of 200 samples, 199 were ND and 1 sample had 0.0025 ppm chlorpyrifos. The assumption was made that chlorpyrifos was found in ground beef to about the extent it would be found in the whole animal muscle tissue. Although chlorpyrifos should tend to partition towards the fatty tissues, this assumption was made because the uncertainty in ground beef fat content and in the fat content of a whole beef carcass is larger than any difference between the two.

Handbook 8 indicates that whole beef carcasses usually have around 23 - 24 % fat. Ground beef can have as much as 30% fat, but is also frequently sold with less than 20% fat. Most ground beef ranges between 17 to 25% fat. No information was available about the fat content of the samples collected by the registrant. Because in the livestock feeding studies kidney and liver samples were generally ND, the conservative assumption was made that kidney, liver, and meat byproducts would have the same chlorpyrifos content as muscle. Fat was assumed to have 5 times more chlorpyrifos incurred than the ground beef assayed in the market basket. This was based upon livestock feeding studies demonstrating that chlorpyrifos concentrates in the fat about 5 times the lean and the fact that ground beef usually contains somewhere around 17 - 25% fat. The anticipated residue for beef is 0.001 ppm.

Gelatin: Gelatin is extracted from the skin, bones, etc of animals otherwise used for food. Most of it is most likely to be beef derived gelatin. Therefore, for gelatin the average result from the ground beef market basket survey was used of 0.001 ppm.

Pork Fat, Muscle, Kidney, Liver and Meat Byproducts: The registrant performed a market basket survey of 200 samples of pork sausage, finding 199 samples ND, and 1 sample with detectable residues at 0.0035 ppm. The same assumptions made for beef were made for pork. Whole hog carcasses average about 35% fat and pork sausage averages 40% fat. The pork fat was assumed to contain five times the amount of chlorpyrifos found in the pork sausage. This is a very conservative estimate based on the fact that chlorpyrifos tends to concentrate in fat over lean by a factor of about 5, and the fact that, according to *Handbook 8*, pork sausage usually has somewhere near 40% fat. The anticipated residue calculated for pork consisted of 199 samples at ½ LOD of 0.001 ppm and the one positive result of 0.0035 ppm resulting in an anticipated residue of 0.001 ppm.

Veal: Veal is only fed milk or milk replacer. Since residues were estimated in milk not to contain more than 0.000723 ppm chlorpyrifos, veal was accepted as containing essentially zero residues of chlorpyrifos, and was not entered in this assessment.

Poultry and Eggs: Anticipated residues were calculated for these commodities using acceptable animal feeding studies (MRID 00095179, 00058087 and 00095438). Residues were calculated based on a diet of field corn grain and peanut meal, or wheat grain and peanut meal. Peanut meal was used in place of soy because there some concerns about the calculated residues in soybeans at the time of this analysis. The two feeds were estimated to result in a dietary burden of 0.004 ppm. From feeding studies done at 10 ppm dietary burden, the lowest concentration that resulted

in measurable residues, the calculated residues in poultry tissues and eggs were as tabulated below.

Table 6. Anticipated residues in Poultry and Eggs

TISSUE	ESTIMATED RESIDUE CONCENTRATION
Muscle	0.000001 ppm
Liver	0.000001 ppm
Kidney	0.000001 ppm
Eggs	0.000002 ppm
Fat	0.000013 ppm

Cherries, Sweet and Sour (tart): FDA analyzed 410 samples of cherries between 1992 - 1997. Of these samples, 55 were above the limit of detection for chlorpyrifos, and results ranged up to 0.257 ppm, with 10 of these results above the limit of quantitation. The remaining 45 trace (above limit of detection samples) are assumed to be at ½ the Limit of Quantification (LOQ), which is 0.0005 ppm for all FDA analyses of chlorpyrifos. Note that 43 of the 55 positive samples came from the Northwest (Oregon or Washington.) According to BEAD a maximum of 24% of sweet cherries and 14% of tart cherries are treated with chlorpyrifos. The sweet cherry anticipated residue was calculated only for the fresh cherries and for home cooked cherry food forms. The tart cherry anticipated residue was calculated for all dried, canned or frozen cherry commodities. Because FDA did not specifically separate sweet and tart cherries in their monitoring program, it was necessary to use the same monitoring data for both varieties. For sweet cherry the anticipated residue was calculated using 312 zeros, 43 samples at ½ LOD of 0.00015 ppm, and 45 at ½ LOQ of 0.0005 ppm and 10 other quantified detects. For tart cherry the anticipated residue was calculated using 353 zeros, 2 at ½ LOD of 0.00015 ppm, 45 at ½ LOQ and 10 other quantified detects. The resulting anticipated residues for sweet cherries is 0.0012 ppm and sour (tart) cherries is 0.0012 ppm. The grape juice processing factor of 0.3 was applied for cherry juice.

Sweet and Field Corn:

Sweet Corn: BEAD has reported that 22% of the sweet corn crop grown for sale as fresh corn is treated with chlorpyrifos, while 9% of the sweet corn crop grown for commercial processing is treated with chlorpyrifos. In addition, separate data sets of FDA analyses of fresh sweet corn and PDP analyses of canned and frozen sweet corn were available. Between 1992 - 1997 FDA analyzed 713 samples of fresh sweet corn for chlorpyrifos and had no positive findings. Since BEAD reported 22% crop treated for fresh marketed sweet corn, an anticipated residue for fresh sweet corn was calculated from 556 samples at zero and 157 samples at ½ LOD resulting in an anticipated residue of 0.00033 ppm. Between 1994 - 1997 PDP analyzed 1306 samples of canned or frozen sweet corn for chlorpyrifos and had no positive findings. The weighted average LOD for these samples is $0.004859 = 0.00243$ for ½ LOD. Since BEAD found that 9% of sweet corn raised for processing was treated with chlorpyrifos, the anticipated residue for canned/frozen

sweet corn was calculated using 1188 zeros and 118 samples at ½ LOD resulting in an anticipated residue of 0.00022 ppm for the chronic dietary analysis.

Field Corn Grain: The assessment used the tolerance and percent crop treated to calculate a chronic anticipated residue in corn at 0.00088 based upon average field trial results of 0.011 ppm and 8.0 % crop treated (MRID 00070509). To convert corn grain data to corn sugar and syrup a processing factor of 0.05 should be used (Knizner, S. Chlorpyrifos Anticipated Residues for DRES Acute Analysis, DP Barcode: D216468, 10/95). To convert corn grain to corn oil a processing factor of 4.5x should be used (Knizner, S. Chlorpyrifos Anticipated Residues for DRES Acute Analysis, DP Barcode: D216468, 10/95).

Cottonseed Oil: The maximum percent crop treated provided by BEAD (Memo 11/98, T. Keilly) for cottonseed is 6 %. Current practice for chronic exposure assessments to use the mean value of the field trial data for dietary exposure in a chronic risk assessment. $6\% * 0.375 * 0.12$ ppm. The anticipated residue used for cotton is 0.0027ppm which should be used for the chronic dietary risk assessment.

- Based on the average residue from these field trials (0.12 ppm) and a reduction factor of 0.375 upon processing into refined oil, for chlorpyrifos acute anticipated residues, a value of 0.045 ppm should be used for cottonseed oil. (Knizner, S. Chlorpyrifos Anticipated Residues for DRES Acute Analysis, DP Barcode: D216468.)

Cucurbits, Cucumbers/Pumpkins: FDA analyzed cucumber samples for chlorpyrifos from 1992 to 1997. They reported results for 407 samples, with one positive finding of 0.080 ppm. BEAD estimated that 1% of the crop was treated. An anticipated residue of was calculated using 403 zeros, 3 samples at ½ LOD of 0.00015 ppm and 1 positive finding at 0.080 ppm resulting in an AR for the chronic dietary risk assessment of 0.000198 ppm. Since pumpkin monitoring data is not available and cucumbers application rate and PHI is similar, then cucumber AR should be translated to pumpkins.

Figs: No monitoring data is available for chlorpyrifos use on figs. The BEAD estimated maximum percent crop is 1%. Tolerance (0.01 ppm) was used as a default residue value directly multiplied by percent crop (0.01) treated resulting in an AR to used in the chronic dietary risk assessment of 0.0001 ppm .

Legume Vegetables, succulent or dried (except soybeans)

Dried Peas: The tolerance for Peas, dried is 0.05 ppm. The anticipated residue was calculated by using ½ tolerance (since there were no detectable residues in the field trial study) times 1% crop treated for the entire dried bean/peas blended commodities. The anticipated residue is 0.025 ppm tolerance X 1% CT = 0.00025 ppm.

Succulent Peas: EPA used the PDP data from 1994 to 1996 provided by the USDA, who analyzed 1458 samples of sweet peas. There was 1 (0.3%) detect at 0.005 ppm and BEAD's estimated percent crop treated for peas is 1 %. The mean residues in succulent peas were calculated detect value of 1 at 0.005 ppm, 14 values @ ½ LOD, and the remaining 1443 values at 0. The anticipated residue used for succulent peas is 3.28634E-05 ppm which should be used for the chronic dietary risk assessment.

Beans, Green: EPA used the PDP data from 1994 to 1995 provided by the USDA, who analyzed 1178 samples of green beans. There were no detects and BEAD's estimated percent crop treated for peas is 1 %. The mean residues in succulent peas were calculated 12 values @ ½ LOD, and the remaining 1166 values at 0. The anticipated residue used for succulent beans is 3.20297E-05 ppm which should be used for the chronic dietary risk assessment.

Milk, fat, whole: The current tolerance of milk, fat is 0.25 ppm and milk, whole is 0.01 ppm. The Codex MRL is 0.01 ppm. USDA generated Pesticide Data Program (PDP) monitoring data. There are 727 data points for the year 1997 in the PDP monitoring data with 0 (0%) detects. The market basket survey resulted in no detects with a limit of detection of 0.001 ppm. The estimated maximum percent crop treated from BEAD's 11/98 memo is 23%. Current SOPs in accordance with ChemSAC decision re: use of LOD vs. LOQ in dietary exposure assessments, 5/19/98, require calculations to use the mean value of the monitoring data and incorporate percent crop treated in calculations with non detects where appropriate (using BEAD percent crop treated data when available) for dietary exposure in a chronic risk assessment. Using the mean concentration from milk market basket monitoring survey of 0.001 ppm with percent crop treated of 23 results in an anticipated residues of 0.00023. This is the anticipated residue recommended for use in the dietary exposure portion of the chronic risk analysis.

Stone fruits, Nectarines, Peaches, Plums

Nectarines: EPA translated the data supplied from PDP monitoring as well as processing data for peaches to nectarines.

Peaches: EPA used the PDP data provided by the USDA. The total number of peaches sampled in PDP during the years of 1994 to 1997 was 1087. The BEAD estimated maximum percent crop treated is 17%. PDP sampling resulted in 130 samples with detections (12%). For dietary exposure in a chronic risk assessment the anticipated residue for peaches is 0.000388 ppm. This represents the mean residue in fresh peaches from the PDP program and is calculated as the average of the 130 detects, the 54 values weighed at ½ LOD and 903 samples of 0 ppm. **Peaches - Canned** During 1997 PDP also analyzed 708 samples of canned peaches with no positive findings. As noted before, BEAD estimates that 17% of peaches are treated with chlorpyrifos. 119 samples were set at the weighted ½ LOD of 0.0025. The remainder of 589 samples were set at zero resulting in an anticipated residue of 0.000425ppm. These data were used for all processed food forms of peaches except peach juice.

Peanuts, Oil, Butter

Peanuts: During the years 1992 to 1997 FDA analyzed 102 samples of peanuts, with 6 detectable residues that ranged up to 0.04 ppm. BEAD estimates that a maximum of 15% of peanuts are treated with chlorpyrifos. All non detects were calculated as ½ the LOD at 0.00015. This yielded an anticipated residue of 0.000022 ppm from 96 samples at ½ LOD of 0.00015 ppm and 6 positive findings. **Peanut butter:** The EPA has used the registrants' market basket survey mean residue of 0.049 ppm for the chronic dietary exposure risk assessment. **Peanut Oil:** The

Chlorpyrifos Registration Standard described an adequate peanut processing study in which peanut nutmeat bearing chlorpyrifos residues at 0.03 ppm were processed into crude, refined, and pressed peanut oil which were found to contain 0.06 ppm, 0.05 ppm, and 0.07 ppm chlorpyrifos respectively (set processing to 2x for concentration for oil)

Pears, Canned, frozen and dried: EPA used the USDA generated Pesticide Data Program (PDP) monitoring data for this analysis. There were 708 samples analyzed for the year 1997 in the PDP monitoring data with 13 (2%) detects and the peak residue at 0.054 ppm. The estimated maximum percent crop treated from BEAD's 11/98 memo is 23%. The mean concentration from pear monitoring data is 0.000965 ppm. This is the anticipated residue recommended for use in the dietary exposure portion of the chronic risk analysis. These results are appropriate for canned and frozen pears, and were calculate using the 13 positive findings, 545 of the non-detects calculated at zero, and 150 of the non-detects set at the weighted ½ LOD of 0.003 ppm.

Fresh Pears, Whole: PDP analyzed single, whole fresh pears during 1998. These were individual pears, not composite samples. There were 160 samples with 3 positive findings at 0.006, 0.007, and 0.028 ppm and an LOD of 0.0044 ppm. BEAD estimates that a maximum of 23% of the pear crop is treated with chlorpyrifos. This yielded an anticipated residue of 0.0007 ppm from 123 samples at zero, 34 at ½ of the weighted average LOD of 0.0022 ppm, and 3 positive findings. Note that this single serving data is still only tentatively accepted for exposure assessment by HED.

Radishes: The current and reassessed tolerance for radishes is 2 ppm. During the years 1992 - 1997 FDA analyzed 118 samples of radishes and demonstrated 13 residues above the limit of detection. The highest detectable residue was 0.099 ppm. BEAD estimates that a maximum of 19% of all roots and tubers are treated with chlorpyrifos. Based on this estimate, an anticipated residue was calculated with 96 zeros, 9 of the non detects set at the ½ LOD of 0.00015 ppm, and 13 residues above the limit of detection resulting in an AR value of 0.00034 ppm.

Rutabagas/Turnips: The current and reassessed tolerance for rutabagas is 0.5 ppm. All roots and tubers have a maximum estimated 19% crop treated (BEAD Memo Attached). All roots and tubers, including rutabagas and turnips were translated from PDP data on sweet potatoes. Therefore an anticipated residue of 0.001211 ppm for chronic dietary exposure risk assessment should be used on rutabagas.

Soybean grain: Field trial data are available in MRID #00095270 depicting residues of chlorpyrifos per se in/on soybeans. Only one field trial reflects current label rates (maximum seasonal application rate of 3 lb ai/A and 28 day PHI). The other 5 available field trials reflect higher application rates (5 lb ai/A) and slightly longer PHIs (28-38 days). The average residue for these field trials is 0.032 ppm x 1% crop treated resulting in an anticipated residue of 0.00032 ppm. The data are summarized below in Table 7.

Table 7. Soybean Field Trials

Location	Application rate (lb ai/A)	PHI (Days)	ppm Chlorpyrifos (3 values seperated by commas)
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<u>MS</u>	<u>3</u>	<u>28</u>	<u>0.004, 0.002, 0.003</u>
<u>IL</u>	<u>5</u>	<u>28</u>	<u>0.016, 0.009, 0.011</u>
<u>GA</u>	<u>5</u>	<u>30</u>	<u>0.001, 0.010, 0.003</u>
<u>IA</u>	<u>5</u>	<u>30</u>	<u>0.024, 0.052, 0.017</u>
<u>NE</u>	<u>5</u>	<u>31</u>	<u>0.010, 0.008, 0.005</u>
<u>NC</u>	<u>5</u>	<u>38</u>	<u>0.014, 0.240, 0.142</u>

Soybean Oil: The soybean AR value of 0.032 ppm was used for soybean oil with a processing factor of 0.14x. (Knizner, S. Chlorpyrifos Anticipated Residues for DRES Acute Analysis, DP Barcode: D216468, 10/95).

Strawberries: During the years 1992 to 1997 FDA analyzed 723 samples of strawberries with 8 (1%) residue samples above the limit of detection up to 0.043 ppm. BEAD estimates that a maximum of 12% of the strawberries are treated with chlorpyrifos. The anticipated residue was calculated by using 636 zeros, 87 set at the weighted ½ LOD of 0.00015 PPM, and the 8 positive findings resulting in 0.00022 ppm. Strawberry juice used this AR and was adjusted with the grape juice processing factor of 0.3.

Sugarcane: Sugarcane - PP#3E4192 MRID 42645401. Since the field trials residue data on sugarcane stalks (the rac) and processed commodities ("A" molasses, bagasse, and refined sugar) were non detects (<0.01 ppm) for all of these commodities after chlorpyrifos treatment (J. Morales, 6/30/93, PP#3E4192), then ½ the LOD is used as the chronic dietary exposure anticipated residue to be used in the risk assessment. **Processing study** resulting in refined sugar having a 0.005x processing factor.

Sweet Potatoes

EPA used the PDP data from 1994 - 1996 provided by the USDA. PDP analyzed 1202 samples of sweet potatoes with 129 positive findings or (10 % detects). BEAD estimates 19% of all root and tuber crops are treated with chlorpyrifos. Current SOPs in accordance with ChemSAC decision re: use of LOD vs. LOQ in dietary exposure assessments, 5/19/98, require calculations to use the mean value of the monitoring data and use non-detects where appropriate (using BEAD percent crop treated data when available) for dietary exposure in a chronic risk assessment. The calculated anticipated residue for sweet potato is .001211 ppm.

Turnip greens: Collard greens were used as a surrogate while retaining percent crop treated for turnips, 19% from BEAD.

Wheat, grain: USDA PDP sampled wheat from 1995 - 1997. There were 1573 samples, with 206 (13%) detects, with 1 positive finding and 184 that were BQLs. All non-detects were set at ½ LOD (weighted average LOD = 0.00482). An anticipated residue was calculated for wheat grain was 0.0032 ppm consisting of the 206 residue values above the limit of detection (avg of 0.008403 ppm) and 1367 results at ½ LOD of 0.00241 ppm. The data from wheat were also used

for wheat flour by incorporating a processing factor of 0.145 (Flood, M. PP#3F2947, 8/10/92). Note that FDA also sampled wheat and had very similar results to those found by PDP.

Mint Oil: Mint oils, spearmint and peppermint using the tolerance for chlorpyrifos on mint hay of 0.8 ppm and a processing factor of 10 (MRID 00034031), combined with a BEAD estimated percent crop treated of 27% resulted in an anticipated residue of 2.16 ppm to be used for a chronic dietary exposure risk assessment.

Beets, Sugar, Molasses: The Chlorpyrifos Second Round Review noted that data reviewed in the Chlorpyrifos Registration Standard demonstrated that residues are not likely to concentrate in refined sugar processed from treated sugar beets. Because chlorpyrifos residues were nondetectable in sugar beets used in the processing study and in the processed fractions obtained from these sugar beets, a reduction factor cannot be calculated. No processing factor was used for beet sugar. The default concentration factor should be set to 1x. Sugar beets are treated similarly to other roots and tubers, except sugar beets are 10% crop treated while others are 19%. There is very little FDA data available on sugar beets, and no data from PDP. Therefore, the data from sweet potatoes and also used for other roots and tubers was used for sugar beets, but was corrected for 10% crop treated resulting in an anticipated residue of 0.001211 ppm for the chronic dietary exposure risk assessment.

Food Handler Establishment Food handling establishment tolerance is not currently set, however, for purposes of a chronic dietary exposure anticipated residue value, 0.01 ppm with a percent crop treated of

Percent Crop Treated

The percent crop treated (PCT) was provided by EAB/BEAD, Analyst: Tim Kiely. Entitled, "Quantitative Usage Analysis for Chlorpyrifos", Case Number: 0100, PC Code: 59101, Dated 11/19/98.

Commodities which are not currently registered for use with Chlorpyrifos:

For a number of commodities for which no chlorpyrifos tolerances have been established, PDP has found residues in more than one year of sampling. These include spinach, squash, and carrots. The residue data for these three commodities are summarized in Table 3 below. Residues were also detected in celery (4 samples in 1994, 0.005 - 0.045 ppm), potatoes (1 sample in 1994, 0.024 ppm), and lettuce (1 sample in 1994 at 0.01 ppm). These residue results were not included in the Agency's dietary exposure assessment as they represent misuse of chlorpyrifos. However, because these violations have occurred over the years, excluding them might have under-represented potential dietary exposure, especially for infants and children. Therefore, an additional set of dietary exposure assessments have been performed including results for squash, spinach and carrots - three commodities frequently fed to infants and children. Celery, lettuce and potatoes were not included. These additional assessments were not significantly different from the original assessments.

- Spinach resulted in an average value of 0.000514 ppm from 1995-'97 PDP data.

- Squash resulted in an average value of 0.0149 ppm from 1997 PDP data.
- Carrots resulted in an average value of 9.8×10^{-05} from 1994, '95, and '96 PDP data.

Recommendation

Please conduct a risk assessment for chlorpyrifos using Table 1 on the following page for each commodity, anticipated residue, references, and concentration/processing factors. Where no processing data is indicated, the default concentration factors in the DEEM system should be used. Percent crop treated should not be used for any commodities in table 1 since they have already been incorporated into all of the anticipated residues. An attachment that lists the percent crop treated is included for reference. Also, conduct a separate exposure assessment including squash, spinach and carrots average monitoring data numbers.

cc: Special Review Branch Special Review and Reregistration Division (7508W), S. Knizner RRB3, Dsmegal RRB3
 RF, DHrdy, circ, List A File, , Chlorpyrifos.
 H-7509C: CBRS: DEH: CM#2: Rm804 (703)305-6990:
 RDI: SVHummel 6/28/99 Team Tuber (RRB4): 6/28/99
 Disk; a:\D247741.wpd

Attachment 1: Percent crop treated, Timothy Keily, EAB/BEAD, 5/13/99.

X:\op chemicals\chlorpyrifos\Chronic Anticipated Residues.wpd

Table 9. Tolerance Reassessment and Anticipated Reassessment Summary.

Commodity	Current Tolerance (ppm)	Tolerance Reassessment (ppm)	[Correct Commodity Definition]/ Comments	AR	%CT	CF	Translating Commodity	Data Origin	% > LOQ	% > LOD	% > LOD < LOQ
Tolerances Listed Under 40 CFR §180.342(a)											
Apples	1.5	1.5		0.0048	53%			Market Basket			
Apple Juice				0.001728	53%			96&97 PDP		0.1	
Beets, sugar, root	1.0	1.0	[Beet, sugar, root].		10%	7/13/95 Knizner					
Beets, sugar, tops	8.0	8.0	[Beet, sugar, tops].		10%						
Lemons	1.0	1.0		0.0009145	16%		Orange				
Grapefruit	1.0	1.0		0.0009145	43%		Orange				
Citrus fruits	1.0	1.0	[Citrus fruits group].	0.0009145	32%		Orange			88	
Oranges	1.0	1.0		0.0009145	54%			'96 PDP		88	
Lemon Juice	1.0	1.0		0.0025			OJ				
Grapefruit Juice	1.0	1.0		0.0025			OJ				
Orange Juice	1.0	1.0		0.0025				PDP 94-97			
Corn, fresh (inc. sweet K-CWHR)	0.1	0.05	[Corn, sweet (K + CWHR)].	2.33237E-05	1%			'96 PDP	0%		
Cranberries	1.0	1.0		0.10	60%	0.3 for juice (grape)		Field Trial			
Kiwifruit	2.0	2.0		8.0 x 10 ⁻⁶				1992-1993 and 1996-1997 FDA			
Mushrooms	0.1	0.1	[Mushroom].	0.001	1% ¹			Tolerance	-	-	-
Onions (dry bulbs)	0.5	0.5	[Onion, bulb].	0.00003	19%			1992-97FDA	0	0	0
Peppers	1.0	1.0	Chlorpyrifos labels from foreign countries that import peppers to the U.S. are required.	0.0083	3%			FDA	4%	5%	1%
Sunflower seeds	0.25	0.1	[Sunflower, seed]. Recommended tolerance from PP#4F3008/FAP#1H5295.	0.000046	1%			10/95 Knizner D216468			

¹5/12/99 Email from Timothy Kiely, BEAD

Commodity	Current Tolerance (ppm)	Tolerance Reassessment (ppm)	[Correct Commodity Definition]/ Comments	AR	%CT	CF	Translated Commodity	Data Origin	%> LOQ	%> LOD	%LOD<LOQ
Tomatoes	0.5	1.0	Chlorpyrifos labels from foreign countries that import tomatoes to the U.S. are required. Recommended tolerance from PP#4F3008/FAP#1H5295.	0.0044	3%	Paste, sauce, etc...		Market Basket survey			
Tree nuts	0.2	TBD	[Tree nuts group]. Additional data and/or label revisions are required.	0.0045	9%		Walnuts Almonds	Field Trial			
Walnuts	0.2	TBD		0.02	39%		Walnuts Almonds	Field Trial			
Almonds	0.2	TBD		0.014	26%		Walnuts Almonds	Field Trial			
Pecans	0.2	TBD		0.018	36%		Walnuts Almonds	Field Trial			
Vegetables, leafy, Brassica (cole)	2.0 (1.0) ^a	1	[Brassica (cole) leafy vegetables group]. Crop Group 5								
Kale				0.006	1%			FDA			
Collards				0.0015	1%			FDA			
Kohlrabi				0.0015	51%		Collards	FDA			
Bok Choi				0.0021	100%			FDA			
Additional Tolerances Required Under 40 CFR §180.342(a)											
Lettuce	None	1	Recommended tolerance from PP#4F03132.								
Peppermint, tops	None	TBD									
Spearmint, tops	None	TBD									
Tolerances Listed Under 40 CFR §180.342(b)											
Asparagus	5.0	5.0	Label revision is required.	0.0006	12%			1992 - 1997FDA data			
Grapes	0.5	1.0	Recommended tolerance from PP#3F02872 and PP#3H05393.		1%			PDP			
Tolerances Listed Under 40 CFR §180.342(c)											
Bananas, pulp with peel removed	0.01	0.01		0.0004242	14%			94, 95 PDP			
Broccoli	1	Revoke	Covered by Brassica (cole) leafy vegetables group.	0.001486	51%			1994-1997PDP	2%	1%	2%
Brussels sprouts	1	Revoke	Covered by Brassica (cole) leafy vegetables group.	0.00281	100%		Broccoli				

Commodity	Current Tolerance (ppm)	Tolerance Reassessment (ppm)	[Correct Commodity Definition]/ Comments	AR	%CT	CF	Translated Commodity	Data Origin	%> LOQ	%> LOD	%>LOD<LOQ
Cabbage	1	Revoke	Covered by Brassica (cole) leafy vegetables group.	0.00111	23%			FDA			
Cattle, fat	0.3	0.3		0.00101							
Cattle, meat	0.05	0.05									
Cattle, meat byproducts	0.05	0.05									
Cauliflower	1	Revoke	Covered by Brassica (cole) leafy vegetables group.	0.0000539	36%			FDA			
Cherries, Tart	1	TBD	Additional data and/or label revisions are required.	0.0012	14%			FDA	2%	11%	1%
Cherries, Sweet	1	TBD		0.0012	24%			FDA			
Chinese cabbage	1	Revoke	Covered by Brassica (cole) leafy vegetables group.	0.00111	1%			Tolerance			
Corn, field, grain	0.05	0.05		0.004	8%			Tolerance			
Corn, Popcorn	0.05	0.05		0.004	8%			Tolerance			
Corn Sweet, Fresh	0.05	0.05		0.00053	13%			PDP	0	0	0
Corn Sweet, Processed	0.05	0.05		0.00022				PDP			
Cottonseed	0.2	0.2		0.012	6%			Tolerance			
Cucumbers	0.05	0.05		0.000198	1%			FDA			
Eggs	0.01	0.01		2x10 ⁻⁶				Knizner			
Figs	0.01	0.01		0.0001	1%			Tolerance			
Goats, fat	0.2	0.2		0.00504			Beef				
Goats, meat	0.05	0.05		0.00101			Beef				
Goats, meat byproducts	0.05	0.05		0.00101			Beef				
Hogs, fat	0.2	0.2		0.00504				Market Basket			
Hogs, meat	0.05	0.05		0.00101							
Hogs, meat byproducts	0.05	0.05		0.00101							
Horses, fat	0.25	0.25		0.00504							
Horses, meat	0.25	0.25		0.00101							
Horses, meat byproducts	0.25	0.25		0.00101							
Legume vegetables, succulent or dried (except soybeans)	0.05	0.05	[Legume vegetables (succulent or dried) group (except soybeans)].		1%						
Beans, Dried	0.05	0.05		0.0005	1%			Tolerance			
Beans, Green	0.05	0.05		0.000032	1%			PDP 96, 97			
Peas, Sweet	0.05	0.05		0.000033	1%			PDP 1996			

Commodity	Current Tolerance (ppm)	Tolerance Reassessment (ppm)	[Correct Commodity Definition]/ Comments	AR	%CT	CF	Translated Commodity	Data Origin	%> LOQ	%> LOD	%>LOD<LOQ
Milk, fat	0.25	0.25	[Milk fat (reflecting 0.01 ppm in whole milk)]/ Recommended tolerance from PP#3F2884.	0.02225							
Milk, whole	0.01	Revoke	Covered by tolerance from milk fat (reflecting 0.01 ppm in whole milk).	0.000723				PDP			
Nectarines	0.01	0.05	Raise tolerance levels to cover both domestic and imported produce (see PP#04E4288/PP#04E4289).	0.000388 Canned: 0.0025	17%			0			
Peaches	0.01	0.05									
Peanuts	0.2	0.2	[Peanuts, nutmeat].	0.01	15%			Knizner 7/14/95			
			[Peanut butter]		15%						
Pears	0.01	0.05	Raise tolerance level to cover both domestic and imported produce (see PP#04E4288/PP#04E4289).	0.000363	23%			97 PDP	1.8		
Plums (fresh prunes)	0.01	0.05	[Plums]/Raise tolerance level to cover both domestic and imported produce (see PP#04E4288/PP#04E4289).	0.000388	6%						
Poultry, fat (inc. turkeys)	0.1	0.1		1.3x10 ⁻⁵				Knizner			
Poultry, meat (inc. turkeys)	0.1	0.1		1x10 ⁻⁶				Knizner			
Poultry, meat byproducts (inc. turkeys)	0.1	0.1		1x10 ⁻⁶				Knizner			
Pumpkins ²	0.05	0.05	[Pumpkin].	0.000198	1%		Cucumber				
Radishes	2	2	[Radish].		19		S. Potato				
Rutabagas	0.5	0.5	[Rutabagas, root].	0.001211	19		S. Potato				
Sheep, fat	0.2	0.2									
Sheep, meat	0.05	0.05									
Sheep, meat byproducts	0.05	0.05									
Soybean grain	0.3	0.3	[Soybean, seed].	0.032	1%	0.14 x 7/13/95 Knizner		Field Trial ³		80	

²Seed Treatment.

³MRID #00095270

Commodity	Current Tolerance (ppm)	Tolerance Reassessment (ppm)	[Correct Commodity Definition]/ Comments	AR	%CT	CF	Translated Commodity	Data Origin	%> LOQ	%> LOD	%>LOD<LOQ
Strawberries	0.2	0.2	[Strawberry].	0.024	12%			Tolerance			
Sugarcane	0.01	0.01		0.005				½ LOD from ND in field trials.			
Sweet potatoes	0.05	0.05	[Sweet potato, root].	0.001211	19%			'97 PDP		10.9	
Turnips	1	1	[Turnip, root].	0.001211	19%		Sweet Potatoes				
Wheat, grain	0.5	0.5		0.000747	1%			'97 PDP	6.4		
Tolerances Listed Under 40 CFR §180.342(d)											
Tolerances Listed Under 40 CFR §185.1000(a)											
Citrus oil	25.0	Revoke	Not appropriate. MRL required.		32%						
Corn oil	3.0	0.25	[Corn, oil, refined]/ Recommended tolerance based on a average concentration factor of 3.3x (see CBRS No. 11372, D188151, S. Knizner, 8/26/93).		8%						
Tolerances Listed Under 40 CFR §185.1000(d)											
Peanut oil	0.4	0.2	Revised procedures for calculating food additive tolerance values. (HAFT (0.11) x avg. processing factor (1.7)).		15%						
Tolerances Listed Under 40 CFR §186.1000(a)											
Beets, sugar, molasses	15.0	15.0	[Sugar beet, molasses].		10%						
Maximum Residue Levels (MRL) Required under 40 CFR											
Citrus oil	None	20			32%						
Peppermint, oil	None	8		2.16	27%	10		Tolerance of Hay			
Spearmint, oil	None	8		2.16	27%	10		Tolerance of Hay			

^a The maximum amount of chlorpyrifos *per se* allowed in this commodity is in parentheses.

^b TBD = To be determined. Reassessment of tolerance(s) cannot be made at this time because either additional data or label revisions are required.

D. CODEX HARMONIZATION

Residue data used to establish US tolerances were examined to determine if US tolerance levels could be adjusted to harmonize with Codex MRLs. Whenever possible, tolerance levels were changed to achieve harmonization.

Several maximum residue limits (MRLs) for chlorpyrifos have been established by Codex in various commodities; see Table E. The Codex MRLs (expressed in terms of chlorpyrifos *per se*) and the U.S. tolerance expression will be compatible when TCP is deleted from the U.S. tolerance expressions.

Compatibility between the U.S. tolerances and Codex MRLs exists for cabbage, Chinese; kale [Brassica (cole) leafy vegetables group]; kiwifruits; milks; poultry meat; and tomatoes. It is recommended that the U.S. tolerance for grapes be raised to 1.0 ppm. This creates compatibility with the codex MRL. It is recommended that the U.S. tolerance for grapes be raised to 1.0 ppm. This creates compatibility with the Codex MRL. Further harmonization of U.S. tolerances and Codex MRLs on other commodities are not feasible at this time.

Table 10. Codex MRLs and Applicable U.S. Tolerances.

Commodity	MRL (mg/kg) ^a	U.S. Tolerance (ppm) ^b	Recommendation/ Comments
Apple	1	1.5	--
Cabbages, head	0.05 ^c	1	--
Carrot	0.5	None	--
Cattle meat	2 (fat)	0.05	--
Cauliflower	0.05 ^c	1	--
Celery	0.05 ^c	None	--
Chicken meat	0.1 (fat)	0.1	Compatibility exists.
Chinese cabbage, type "Pe-tsai"	1	1	Compatibility exists.
Citrus fruits	0.3	1.0	--
Common bean (pods and/or immature seeds)	0.2	0.05 (Legume vegetables group, except soybeans)	--
Cottonseed	0.05 ^c	0.2	--
Cotton seed oil, crude	0.05 ^c	None	--
Dried grapes	2	0.5	Recommend increase to 1.0.
Egg plant	0.2	None	--
Eggs	0.05 ^c	0.01	--
Grapes	1	0.5	Recommend increase to 1.0.
Kale	1	1 (Brassica (cole) leafy vegetables group)	Compatibility exists.
Kiwifruit	2	2.0	Compatibility exists.
Lettuce, head	0.1	1 (proposed)	--
Milks	0.01 ^c	0.01	Compatibility exists.
Mushrooms	0.05 ^c	0.1	--
Onion, bulb	0.05 ^c	0.5	--
Pear	0.5	0.01	--
Peppers	0.5	1.0	--
Potato	0.05 ^c	None	--
Raspberries, red, black	0.2	1.0 (canberries)	--

Commodity	MRL (mg/kg) ^a	U.S. Tolerance (ppm) ^b	Recommendation/ Comments
Rice	0.1	None	--
Sheep meat	0.2 (fat)	0.05	--
Sugar beet	0.05 ^c	1.0	--
Tomato	0.5	1.0	--
Turkey meat	0.2 (fat)	0.1 (poultry meat, including turkeys)	--

^a All chlorpyrifos MRLs are final (CXL).

^b Based on chlorpyrifos *per se*.

^c At or about the limit of detection.

Quantitative Usage Analysis for Chlorpyrifos

Case Number: 0100 PC Code: 59101
Date: 5/13/99 Analyst: Tim Kiely

Based on available pesticide survey usage information for the years of 1987 through 1998, an annual estimate of chlorpyrifos' total domestic usage is approximately 20,960,000 pounds active ingredient (a.i.) for 8,025,000 acres treated. Most of the acreage is treated with 2.3 pounds a.i. or less per application and 3.9 pounds a.i. or less per year. Chlorpyrifos is an insecticide with its largest agricultural markets in terms of total pounds a.i. allocated to corn (26%) and cotton (3%). No other crop is treated with more than 2.6% of the total pounds of chlorpyrifos applied. The largest non-agricultural markets in terms of total pounds of a.i. applied are PCOs, termite control (24%) and turf (12%). Crops with a high percentage of their total U.S. planted acres treated include cranberries (46%), apples (44%), broccoli (41%), brussels sprouts (33%), and cauliflower (31%).

This quantitative usage analysis updates estimates provided in an earlier BEAD usage profile (Grube, 12/96).

Table 11. U.S. EPA, Quantitative Usage Analysis, Chlorpyrifos, November 24, 1998 (revised May, 13 1999).

Site	Acres Grown (000)	Acres Treated (000)		% of Crop Treated		LB AI Applied (000)		Average Application Rate			States of Most Usage
		Wtd Avg	Est Max	Wtd Avg	Est Max	Wtd Avg	Est Max	lb ai/ acre/yr	#appl / yr	lb ai/ A/appl	(% of total lb ai used on this site)
Cranberries	35	16	21	46%	60%	26	34	1.6	1.0	1.6	MA NJ WI 94%
Strawberries	50	3	6	6%	12%	8	15	2.5	1.1	2.3	CA NC OR MD MI NY 79%
Citrus, Other /1	51	8	16	16%	32%	12	25	1.5	1.2	1.2	FL CA 81%
Grapefruit	194	23	32	12%	16%	44	65	1.9	1.4	1.4	FL TX 82%
Lemons	63	19	27	30%	43%	55	72	2.9	1.3	2.2	CA AZ 99%
Oranges	867	118	165	14%	19%	460	578	3.9	1.3	2.9	CA FL 96%
Apples	572	251	305	44%	53%	550	750	2.2	1.6	1.4	WA MI NY CA VT NC 77%
Figs	16	0*	0*	0%	0%	0*	0*	-	-	-	
Pears	78	10	18	13%	23%	19	37	1.8	1.1	1.7	WA OR CA MI 83%
Nectarines	38	3	4	8%	11%	5	7	1.7	1.0	1.7	
Cherries	128	18	25	14%	19%	34	60	1.9	1.2	1.6	MI OR WA 86%
Peaches	212	23	37	11%	17%	41	52	1.8	1.4	1.3	CA SC GA NJ TX OK 62%
Plums & Prunes	140	7	9	5%	6%	11	20	1.6	1.1	1.5	CA WA OR 82%
Grapes	825	4	6	0%	1%	4	8	1.0	1.1	0.9	AR OH WA MI NC FL 68%
Almonds	429	88	124	20%	29%	185	270	2.1	1.2	1.8	CA 100%
Pecans	488	143	174	29%	36%	240	414	1.7	1.9	0.9	TX GA LA OK 85%

Site	Acres Grown (000)	Acres Treated (000)		% of Crop Treated		LB AI Applied (000)		Average Application Rate			States of Most Usage
		Wtd Avg	Est Max	Wtd Avg	Est Max	Wtd Avg	Est Max	lb ai/ acre/yr	#appl / yr	lb ai/ A/appl	(% of total lb ai used on this site)
Walnuts	205	62	80	30%	39%	197	230	3.2	1.5	2.1	CA 100%
Nut Trees, Other /2	100	6	9	6%	9%	7	18	1.2	1.2	1.0	
Onions	152	20	29	13%	19%	24	35	1.2	1.0	1.2	OR NY MI NM GA CA 86%
Peppers, Bell	65	1	2	2%	3%	4	8	4.0	3.2	1.3	FL 100%
Kale	6	0	0	0%	0%	0	2	1.0	1.0	1.0	
Mustard	-	-	-	-	-	-	-	-	-	-	
Broccoli	111	45	57	41%	51%	73	87	1.6	1.4	1.2	CA 82%
Brussels Sprouts	3	1	3	33%	100%	7	10	7.0	5.1	1.4	
Cabbage	85	11	20	13%	23%	10	22	0.9	1.0	0.9	CA FL GA TX WA NY 77%
Cabbage, Chinese	9	0	0	0%	0%	2	5	1.0	1.0	1.0	
Cauliflower	58	18	21	31%	36%	27	38	1.5	1.7	0.9	CA AZ 82%
Collards	11	1	2	12%	13%	1	1	0.4	1.0	0.4	FL AZ NJ 84%
Kohlrabi	-	-	-	-	-	-	-	-	-	-	
Broccoli raab	-	-	-	-	-	-	-	-	-	-	
Cucurbits /3	285	1	3	0%	1%	1	6	1.0	1.4	0.7	NC MI FL CA AZ IA 82%
Asparagus	89	6	11	7%	12%	5	9	0.8	1.0	0.8	WA MI 82%

Site	Acres Grown (000)	Acres Treated (000)		% of Crop Treated		LB AI Applied (000)		Average Application Rate			States of Most Usage
		Wtd Avg	Est Max	Wtd Avg	Est Max	Wtd Avg	Est Max	lb ai/ acre/yr	#appl / yr	lb ai/ A/appl	(% of total lb ai used on this site)
Roots/Tubers /4	244	33	46	14%	19%	74	86	2.2	1.1	2.0	NC CA MS LA 83%
Sweet Corn	784	86	105	11%	13%	120	192	1.4	1.4	1.0	FL WA WI MN OR NY 69%
Tomatoes	500	11	16	2%	3%	35	53	3.2	3.1	1.0	FL 90%
Lentils	131	-	-	-	-	-	-	-	-	-	
Beans/Peas, Green	723	2	4	0%	1%	2	4	1.0	1.0	1.0	OR MD IL WI 87%
Beans/Peas, Dry	2,181	4	6	0%	0%	4	7	1.0	1.0	1.0	MI ND MN CO IL 83%
Sorghum	11,280	210	349	2%	3%	148	239	0.7	1.1	0.6	TX MS KS OK NE LA 76%
Corn	71,264	4,678	6,053	7%	8%	5,527	6,949	1.2	1.1	1.1	IL IA NE IN WI OH 71%
Rice	2,921	1	7	0%	0%	3	14	3.3	1.0	3.3	LA AR 81%
Tobacco	695	73	96	11%	14%	146	197	2.0	1.0	2.0	NC SC VA GA 81%
Wheat, Spring	20,799	29	100	0%	0%	35	90	1.2	1.0	1.2	ND MN 92%
Wheat, Winter	43,282	250	400	1%	1%	170	350	0.7	1.2	0.6	TX CO KS WY MT NM 84%
Alfalfa	23,949	675	835	3%	3%	480	700	0.7	1.1	0.7	CA PA MO IL KS CO 55%

Site	Acres Grown (000)	Acres Treated (000)		% of Crop Treated		LB AI Applied (000)		Average Application Rate			States of Most Usage
		Wtd Avg	Est Max	Wtd Avg	Est Max	Wtd Avg	Est Max	lb ai/ acre/yr	#appl / yr	lb ai/ A/appl	(% of total lb ai used on this site)
Peanuts	1,610	158	240	10%	15%	316	480	2.0	1.1	1.8	GA NC VA AL 85%
Soybeans	61,279	90	150	0%	0%	60	91	0.7	1.0	0.7	IL IA OH SD IN NE 53%
Sunflower	2,745	7	13	0%	0%	5	8	0.7	1.1	0.7	MN CO CA KS 81%
Cotton	12,429	645	806	5%	6%	670	890	1.0	1.7	0.6	AZ MS CA TX LA 84%
Sugar Beets	1,415	118	146	8%	10%	160	307	1.4	1.5	0.9	CA ND MN 86%
Mint	154	29	42	19%	27%	41	66	1.4	1.0	1.4	OR ID IN WA 92%
Bananas	See Below	-	-	-	-	-	-	-	-	-	
Lots/Farmsteads/etc	24,815	7	14	0%	0%	10	16	1.4	2.2	0.7	FL OK GA KS MS IA 60%
Pasture	86,960	7	12	0%	0%	9	19	1.2	1.6	0.7	TX FL CA 83%
Woodland	62,825	5	9	0%	0%	8	17	1.5	1.6	1.0	GA PA TX FL MI 83%
Nursery/Greenhouse	-	-	-	-	-	277	567	-	-	-	

Site	Acres Grown (000)	Acres Treated (000)		% of Crop Treated		LB AI Applied (000)		Average Application Rate			States of Most Usage
		Wtd Avg	Est Max	Wtd Avg	Est Max	Wtd Avg	Est Max	lb ai/ acre/yr	#appl / yr	lb ai/ A/appl	(% of total lb ai used on this site)
PCOs, Termite Control /5	-	-	-	-	-	5,003	6,000	-	-	-	
PCOs, other /6	-	-	-	-	-	1,946	3,000	-	-	-	
MADs /7	-	-	-	-	-	29	50	-	-	-	
Turf /8	-	-	-	-	-	2,519	3,000	-	-	-	
Households, Outdoor	-	-	-	-	-	1,112	1,500	-	-	-	
Total, U.S.		8,025	9,340			20,960	24,365				
	Millions of Tons										
	Imported	Treated		% Treated							
		Avg	Max	Avg	Max						
Bananas /9	3	0.4	0.5	13%	14%						

COLUMN HEADINGS

Wtd Avg = Weighted average--the most recent years and more reliable data are weighted more heavily.

Est Max = Estimated maximum, which is estimated from available data.

Average application rates are calculated from the weighted averages.

NOTES ON TABLE DATA

Usage data primarily covers 1987 - 1998. Calculations of the above numbers may not appear to agree because they are displayed as rounded to the nearest 1000 for acres treated or lb. a.i. (Therefore 0 = < 500) to the nearest whole percentage point for % of crop treated. (Therefore 0% = < 0.5%)

0* = Available EPA sources indicate that no usage is observed in the reported data for this site, which implies that there is little or no usage.

A dash (-) indicates that information on this site is NOT available in EPA sources or is insufficient.

/1 Citrus, Other includes kumquats, limes, tangelos, and tangerines.

/2 Nut Trees, Other includes chestnuts, filberts (hazelnuts), and macadamia nuts.

/3 Cucurbits includes cucumber, and pumpkin.

/4 Root and Tuber Crops include carrots, radish, rutabagas, sweet potatoes, and turnips.

/5 PCOs, Termite Control: pest control operators, termite control.

/6 PCOs, Other includes use for control of cockroaches, ants, fleas, and other general pests.

/7 MADs: mosquito abatement districts.

/8 Turf includes golf courses, turf farms, institutional turf, lawncare control operators, and landscape contractors.

/9 The estimates for bananas are based on import data. The two countries indicating a use of chlorpyrifos are Columbia and Honduras.

SOURCES:

EPA proprietary data (Doane Marketing Research, Kline Professional Markets for Pesticides and Fertilizers, Maritz Marketing Research, Mike Buckley and Associates),

National Center for Food and Agricultural Policy,

USDA, NASS, ERS, Agriculture Chemical Usage: Vegetable Summary (1996, 1994),

USDA, NASS, ERS, Agriculture Chemical Usage: Fruits Summary (1997, 1995),

USDA, NASS, ERS, Agriculture Chemical Usage: Field Crops Summary (1997, 1996).

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